Fisheries Session

Size and Age Structure of a Single School of Striped Bass in Lake Greeson, Arkansas

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Abstract: A school of 206 striped bass, *Morone saxatilis*, were sampled using rotenone in a deep, southwest Arkansas reservoir. Fish averaged 439 mm TL and 823 g in weight, ranging in size from 321 to 525 mm TL and 335–1,389 g. K factors were extremely low, ranging from 0.82 to 1.18. Two hundred four of the striped bass were age II+ (1981 year class), while only 2 were age I+. Several possible reasons are considered as the causative agent in the formation of this large school.

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Schooling of fish, a phenomenon observed for centuries, has just recently received the work and attention necessary to unravel many of the mysteries and misconceptions associated with it. Schooling among fish is widespread with an estimated 10,000 of the total 20,000 species of fish forming schools during some part of their lives (Partridge 1982). While striped bass fall into the category of schooling fish, most studies relative to this behavior in the species have been conducted in the marine environment (Setzler et al. 1980). The numerical size of striped bass schools found in freshwater lakes or rivers has not been well documented. This paper relates the size and age distribution of a single school of striped bass from Lake Greeson, Arkansas. The data became available when an unforeseen occurrence allowed fisheries biologists to obtain length, weight, and age information from at least a portion of a large school of striped bass from an inland, southeastern reservoir.

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Methods

Lake Greeson was created in 1950 by impounding the waters of the Little Missouri River in southwest Arkansas. The lake has a surface area of 2,939 ha at the maximum power pool elevation of 167m mean sea level. At maximum power pool,

the lake has a total shoreline length of 216 km and an average depth of 8.5 m. It was constructed by the U.S. Army Corps of Engineers for hydroelectric power generation and flood control.

Striped bass reported on in this paper were sampled outside of a standard cove rotenone sample (as outlined by Surber 1959). All striped bass reported were picked up outside of the block net. Fish were weighed to the nearest gram and measured to the nearest mm TL. Age of fish was determined from scales collected below the lateral line and posterior to the pectoral fin. Scales were heat pressed on acetate and read using an Eberbach macro-projector. K factors were calculated for 25 mm size intervals and for the entire sample using the relationship

$$K = \frac{W \times 100{,}000}{L^3}$$

(Rounsefell and Everhart 1953). A length-weight regression was computed for all fish and plotted using an Apple II-E microcomputer.

Results

A total of 206 striped bass were recovered outside of the block-off net on the second day of a routine cove rotenone sample. This occurred probably as a result of

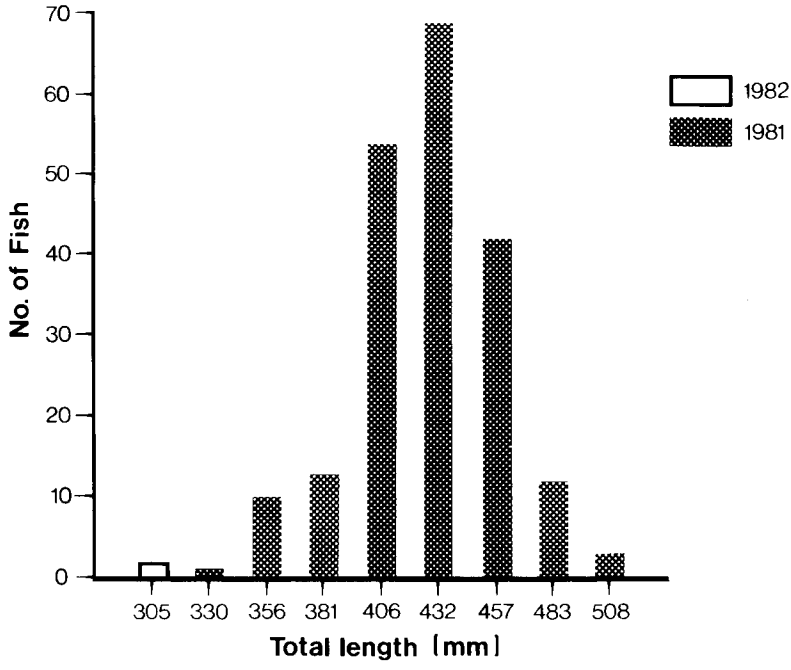

Figure 1. Length-frequency and age composition of a school of striped bass from Lake Greeson, Arkansas.

a cool water density current slightly above the thermocline that carried enough of the fish toxicant outside of the study area to affect a large school of striped bass that had moved into the cove. At approximately 1600 hours on 14 July 1983 (the second day of a 2-day sample), the first striped bass began surfacing outside of the designated sample area and striped bass mortalities continued for 40 minutes thereafter. The range in size of the striped bass was 321 mm to 525 mm TL and 335 g to 1,389 g. The length-weight regression equation of all fish was Wt(g) = −1432.76594 + 5.14106TL(mm). Condition factors (K) ranged from 0.82 to 1.18. Mean total length was 439 mm ± 33 SD and mean weight was 823 g ± 177 SD with a correlation coefficient of 0.96.

A length frequency histogram shows a bell shaped size distribution (Fig. 1). Of the 206 striped bass sampled, 204 were 1981 year class fish (age II+) and only 2 were 1982 year class fish (I+).

Discussion

Since the author did not have the opportunity to observe the 206 striped bass as they moved into the sample cove, it is debatable whether this group of fish did actually constitute a "school." Behaviorists are quite specific concerning the need for a biosocial attraction requirement among the fish in a school (Nikolsky 1963, Keenleyside 1979). However, since striped bass are known to school, since all 206 fish came to the surface in a relatively short period of time (considering the variability in susceptibility of fish to rotenone) and because all the fish were of a similar size, it was appropriate to refer to this large group of striped bass as a school.

Setzler et al. (1980) in their review of striped bass literature, stated that striped bass during the first 2 years are primarily found in small groups which get larger as the fish increase in weight up to 4.5 kg. Past this size, although they sometimes school, they are more likely to be found in small groups or individually. From the literature available on the subject, from personal communication with numerous fisheries biologists in the southeastern United States and considering the number of striped bass recorded was probably a minimum estimate of the school, a school of the size observed in this study is considered to be numerically large.

There are several explanations for the schooling of fish including protection, reproduction, reduction in the availability of preferred habitat and feeding. During the time of year when the striped bass in this study were sampled (summer) and due to their size and trophic level, logical reasons for the formation of this school might have been feeding or restrictive thermal refuges (Coutant 1985). Bond (1979) reported that location of prey could be facilitated by fish moving as a group since, when food is encountered on one side of the school, the other side is soon made aware of it. Also, he reported that young fish feeding in a social group tended to grow faster than those eating by themselves. Visual stimuli of the feeding act may also trigger nonfeeding individuals to feed (Lagler et al. 1962). Search and chase type predators (i.e. striped bass) have been shown to break up prey schools, forcing disorientation and straggling (Webb 1984). Lake Greeson is a deep reservoir with

fairly deep coves that provide acceptable habitat for striped bass, even in late summer. Since striped bass are highly mobile predators, it would not be unusual for a school to move into the mouth of an embayment in search of prey. Crance (1984) suggested a clupeid standing crop of 84.1 kg/ha as optimal for an inland striped bass fishery. The low clupeid standing crop of Lake Greeson (<22.4 kg/ha in 1983) in the lower lake area would therefore tend to require efficient feeding strategies for predators reliant on shad (*Dorosoma* sp.).

The school of striped bass reported in this paper were found in the lower portion of the lake in the summer, similar to areas inhabited by adult striped bass as reported by other fisheries investigations (Schaich and Coutant 1980, Cheek et al. 1985). However, several factors preclude the thermal refuge hypothesis as a valid explanation of this particular congregation of striped bass. First, fish were dying outside of the block net on the first and second day in the area where the 206 striped bass were eventually recovered. Had striped bass been in a thermal refuge in the cove sampled, as sensitive as striped bass are to rotenone, they probably would have been affected by the toxicant on the first day. Instead, they did not begin surfacing until 1600 hours of the second day of sampling. Second, striped bass recovered had low condition factors but were not emaciated. Internal examination of the fish did not show black-green gall bladders usually symptomatic of "unused digestive capability" (Coutant 1983). Low condition factors of 1981 striped bass in Lake Greeson are more indicative of an overly abundant year class of striped bass and a low forage base than of an emaciated cohort. Also, juvenile striped bass, such as the 206 reported here, are more tolerant of elevated water temperatures than adults and have higher thermal preferences (Schaich and Coutant 1980). Finally, monthly gill netting, as part of the SDAFS Striped Bass Committee's fingerling survival study on the lake, sampled juvenile striped bass in all zones of the lake (upper, mid, lower) during the summer and some in relatively shallow water.

While the mean total length of the striped bass in this study (439 mm) was not far off that reported by Mensinger (1971) for Oklahoma striped bass (age II), condition factors of Lake Greeson striped bass were extremely low. These values, ranging from 0.82 to 1.18, mirror a decline in the shad population in the lake. They also indicate (along with monthly gill net data since 1982) above average survival of the 1981 nursery pond crop of striped bass which was released into the lake. The 1981 year class of striped bass had comparatively low condition factors when compared to other southeast striped bass fisheries. Wigfall (1975) reported a range of condition factors of 1.65 to 2.54 for 121 striped bass from the Choctawhatchee River in Florida, while Ware (1971) also reported K values higher (1.31 to 2.79) than those calculated for this study. Ware categorized values under 1.8 as poor and found some mortality for those fish with values under 1.7. There were no significant difference between K factors for 25 mm size groups in this study with all K factors being extremely low.

While this incident and the data obtained from it reinforced fears about the decreasing shad population in Lake Greeson, other important and positive data were

also procured. Analysis of the size and age composition of the 206 striped bass mirrors what Bond (1979) and others have reported. Even in extremely large schools, members of a given group will be of the same approximate size. This size relationship has been shown to be related to the swimming speed of various fish.

Relative to the management of the striped bass fishery in Lake Greeson, large scale die-offs of adult striped bass (5 kg) have occurred in Greeson in previous years (Matthews 1985). Above average survival of the 1981 year class of striped bass may cause future summer mortalities to be high as this year class grows into the adult size range. The temperature, dissolved oxygen "squeeze" documented in several studies (Coutant and Carroll 1980, Cotant 1985) may cause drastic reductions in the 1981 year class of striped bass.

Finally, juvenile striped bass may form large foraging schools in southeastern reservoirs in order to prey more efficiently on scattered and/or clustered food organisms. Additional investigation into this behavior is necessary and would aid in management and understanding of this large, transplanted predator.

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